

**AIRSHAFT****CROSS-REFERENCE TO RELATED APPLICATION**

This application claims priority of Taiwanese application no. 092206368, filed on April 22, 2003.

**5 BACKGROUND OF THE INVENTION****1. Field of the Invention**

The invention relates to an airshaft, more particularly to an airshaft that is capable of holding a roll of web material.

**10 2. Description of the Related Art**

An airshaft is mounted rotatably on a machine, and is expandable by use of pressurized air so as to hold a roll of web material, such as paper, rubber, plastic, metal, fabric, wire, or the like, thereon.

**15** As shown in Figures 1 and 2, a conventional airshaft includes a shaft body 11 and an inflatable unit 12 retained on the shaft body 11. The inflatable unit 12 includes a plurality of inflatable bladder members that, when inflated, protrude from the surface of the shaft  
**20** body 11 to abut against a roll 2 of web material sleeved on the airshaft so as to hold the roll 2 on the shaft body 11. The roll 2 generally includes a cardboard tubular core or a metal tubular core. In use, an inner diameter of the roll 2 is larger than an outer diameter  
**25** of the shaft body 11. Accordingly, when the inflatable unit 12 is inflated, the inflatable unit 12 expands in radial outward directions to be able to hold the roll

2 on the shaft body 11.

It is noted that the greater the extent of expansion of the inflatable unit 12, the larger will be the holding force exerted on the roll 2 to ensure rotation of the roll 2 with the shaft body 11. However, when the extent of expansion of the inflatable unit 12 is unduly large, the degree of rotational concentricity of the roll 2 with respect to the shaft body 11 will be adversely affected in view of deformation of the roll 2 at contact areas with the inflatable unit 12 such that, when the shaft body 11 rotates about an axis thereof, rotational deviation of the web material being wound on the roll 2 is likely to occur. This problem is aggravated under high-speed conditions and during heavy web material applications. The aforesaid rotational deviation not only affects production quality, but also subjects the shaft body 11 to imbalanced forces that can interrupt production and that can shorten the service life of the airshaft.

## **SUMMARY OF THE INVENTION**

Therefore, the object of the present invention is to provide an airshaft that can overcome the aforesaid drawbacks associated with the prior art.

Accordingly, an airshaft of this invention comprises:

an elongate shaft body having a shaft axis and an outer cylindrical shaft surface formed with at least

three longitudinally extending bladder retaining grooves, each of the bladder retaining grooves being generally inverted T-shaped and having a narrower access opening formed in the shaft surface and a wider retaining section disposed between the access opening and the shaft axis;

a set of elongate inflatable bladder members, each of which is received in the retaining section of a respective one of the retaining grooves; and

a plurality of roll contact pieces, each of which has a biased side disposed in the retaining section of one of the retaining grooves and in contact with the inflatable bladder member in the corresponding retaining groove, and a roll contacting side extending out of the corresponding retaining groove through the access opening of the corresponding retaining groove, the roll contacting side having a distal contact face.

The roll contact pieces include a set of first roll contact pieces and a set of second roll contact pieces.

The distal contact face of the roll contacting side of each of the first roll contact pieces forms a first height with the inflatable bladder member in the corresponding retaining groove. The distal contact face of the roll contacting side of each of the second roll contact pieces forms a second height with the inflatable bladder member in the corresponding retaining groove. The second height is shorter than the first height.

When a roll of web material is sleeved on the shaft body, and when the inflatable bladder members are inflated, the distal contact faces of the roll contacting sides of the first roll contact pieces contact the roll of web material for holding the roll of web material on the shaft body, and the distal contact faces of the roll contacting sides of the second roll contact pieces contact the roll of web material for positioning stably the roll of web material on the shaft body.

10 **BRIEF DESCRIPTION OF THE DRAWINGS**

Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiments with reference to the accompanying drawings, of which:

15 Figure 1 is a schematic partly sectional view of a conventional airshaft;

Figure 2 is a magnified view of an encircled portion of the conventional airshaft of Figure 1;

20 Figure 3 is an assembled sectional view of the first preferred embodiment of an airshaft according to the present invention;

Figure 4 is an assembled fragmentary perspective view of the first preferred embodiment;

25 Figure 5 is a fragmentary assembled sectional view of the first preferred embodiment; and

Figure 6 is an assembled perspective view of the second preferred embodiment of an airshaft according

to the present invention.

#### DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

As shown in Figures 3, 4 and 5, the first preferred embodiment of an airshaft according to this invention is shown to include a shaft body 3, an inflatable unit 4 retained on the shaft body 3, and an air pumping unit 5 connected to the inflatable unit 4.

The shaft body 3 has a shaft axis (A), and an outer cylindrical shaft surface 30 formed with at least three longitudinally extending bladder retaining grooves 31. Each of the bladder retaining grooves 31 is generally inverted T-shaped, and has a narrower access opening 311 formed in the shaft surface 30 and a wider retaining section 312 disposed between the access opening 311 and the shaft axis (A). In this embodiment, each of the bladder retaining grooves 31 extends parallel to the shaft axis (A).

The inflatable unit 4 includes a set of elongate inflatable bladder members 411 and a plurality of roll contact pieces 412. Each inflatable bladder member 411 is received in the retaining section 312 of a respective one of the bladder retaining grooves 31. Each roll contact piece 412 has a biased side 4122 disposed in the retaining section 312 of one of the retaining grooves 31 and in contact with the inflatable bladder member 411 in the corresponding retaining groove 31, and a roll contacting side 4121 extending out of the corresponding

retaining groove 31 through the access opening 311 of the corresponding retaining groove 31. The roll contacting side 4121 has a distal contact face 4120 distal from the inflatable bladder member 411 in the corresponding retaining groove 31.

The roll contact pieces 412 include a set of first roll contact pieces 412A and a set of second roll contact pieces 412B. The distal contact face 4120 of the roll contacting side 4121 of each of the first roll contact pieces 412A forms a first height with the inflatable bladder member 411 in the corresponding retaining groove 31. The distal contact face 4120 of the roll contacting side 4121 of each of the second roll contact pieces 412B forms a second height with the inflatable bladder member 411 in the corresponding retaining groove 31. The second height is shorter than the first height.

In this embodiment, the roll contact pieces 412 are disposed side-by-side on the inflatable bladder member 411 in the corresponding retaining groove 31. Moreover, a total area of the distal contact faces 4120 of the roll contacting sides 4121 of the first roll contact pieces 412A is less than that of the distal contact faces 4120 of the roll contacting sides 4121 of the second roll contact pieces 412B.

The air pumping unit 5 is connected to the inflatable bladder members 411 and is operable so as to inflate the inflatable bladder members 411.

In use, when a roll 6 of web material is sleeved on the shaft body 3, and when the inflatable bladder members 411 are inflated with the use of the air pumping unit 5, the inflatable bladder members 411 expand in radial outward directions such that the distal contact faces 4120 of the roll contacting sides 4121 of the first roll contact pieces 412A contact the roll 6 of web material to exert a stronger force sufficient for holding the roll 6 of web material on the shaft body 3, thereby preventing removal of the roll 6 from the shaft body 3, whereas the distal contact faces 4120 of the roll contacting sides 4121 of the second roll contact pieces 412B contact the roll 6 of web material to exert a weaker force sufficient for positioning stably the roll 6 of web material on the shaft body 3, thereby maintaining rotational concentricity of the roll 6 with respect to the shaft axis (A).

Therefore, in practice, the length of the first roll contact pieces 412A does not have to be too long to achieve the intended effect of holding the roll 6 of web material on the shaft body 3. Moreover, the second height of the second roll contact pieces 412B is only required to be large enough to position stably the roll 6 of web material 6 such that the second roll contact pieces 412B do not press tightly against the roll 6 of web material to avoid the undesired rotational deviation commonly encountered in the prior art. As such, because two

complementary holding and positioning effects are respectively attributed to the first and second roll contact pieces 412A, 412B, the roll 6 of web material will not encounter the problem of rotational deviation during use of the airshaft of this invention so that a smooth rolling operation is ensured and so that the service life of the airshaft can be prolonged.

Figure 6 illustrates the second preferred embodiment of an airshaft according to this invention. Unlike the first preferred embodiment, each of the bladder retaining grooves 31 in the embodiment of Figure 6 extends along a twisted line with respect to the shaft axis (A). The resulting helical arrangement of the roll contact pieces 412 on the shaft body 3 enhances the rotational concentricity of the roll of web material during rotation of the shaft body 3.

While the present invention has been described in connection with what is considered the most practical and preferred embodiments, it is understood that this invention is not limited to the disclosed embodiments but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.